

ANSI Z136.8 Update

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LSO Workshop 2010
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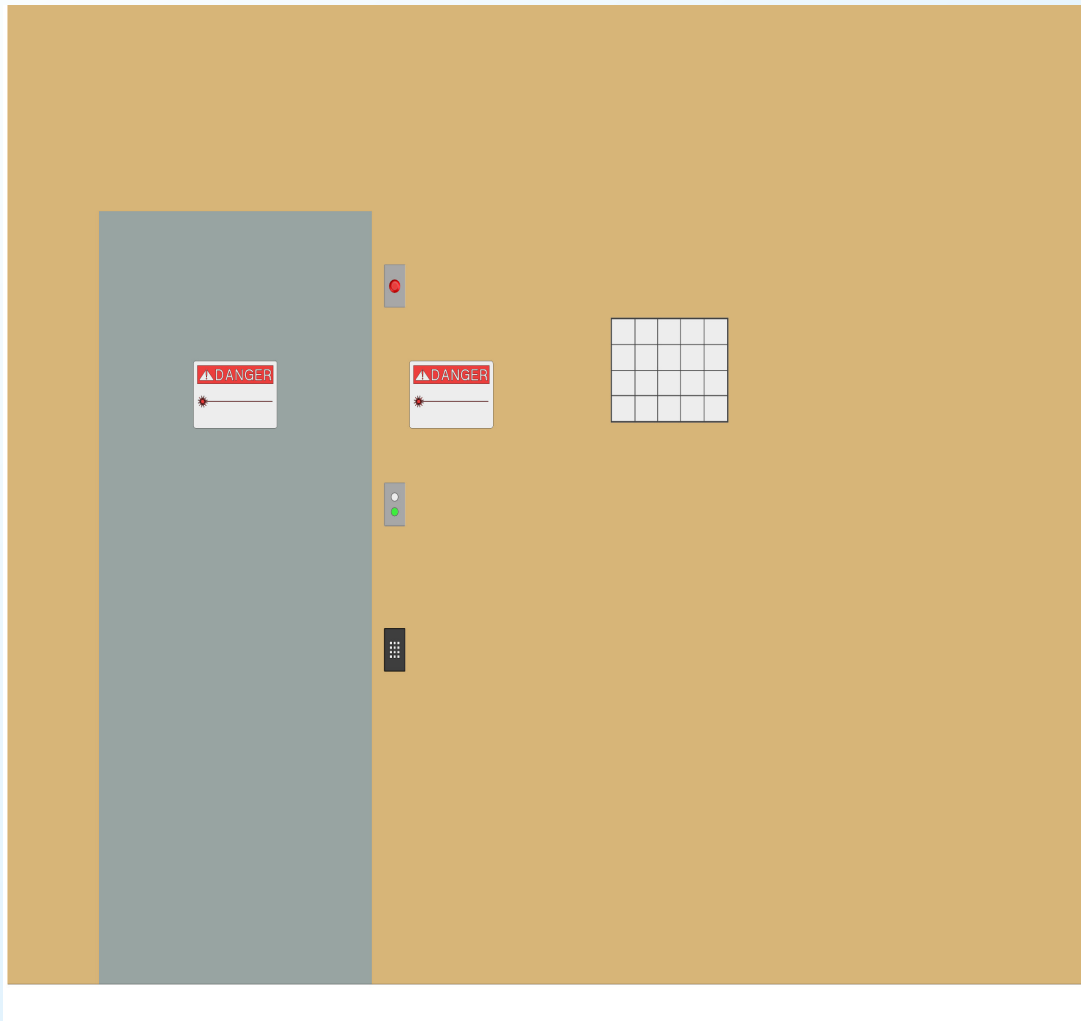




Z136.8 Laser Safety in the Research , Development and Testing Environment

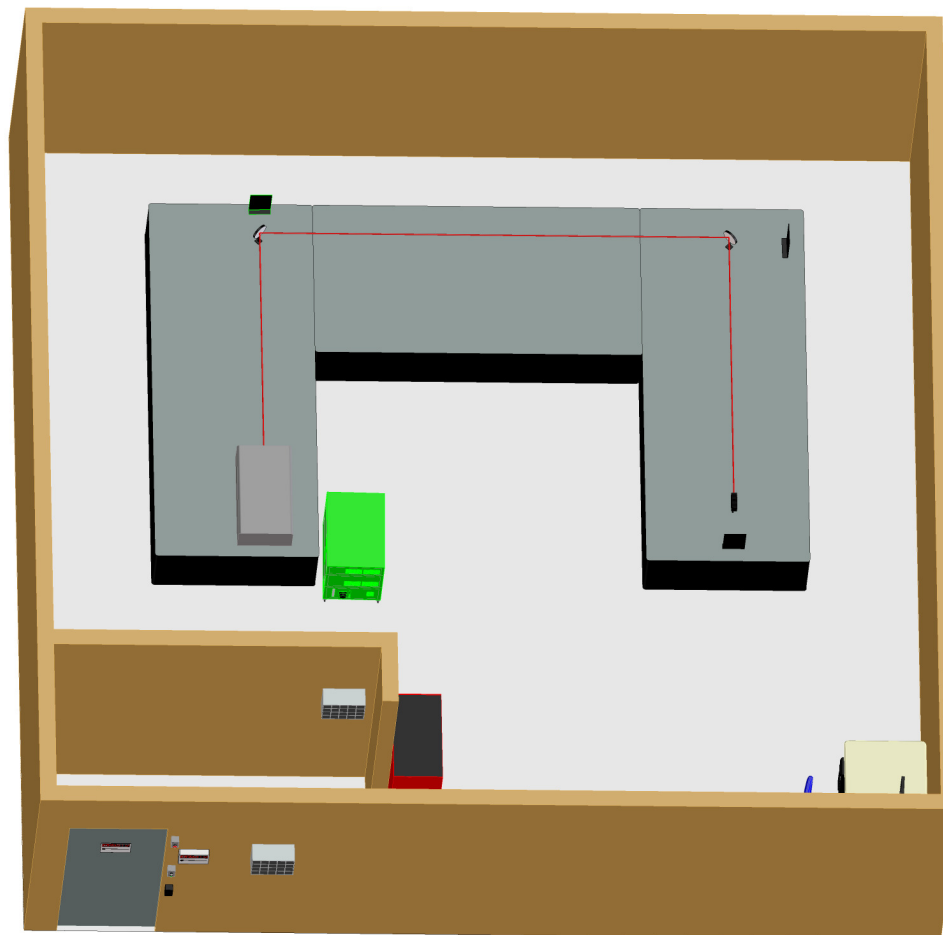
- Present status
- Subcommittee vote completed
 - Approved with comments
 - No comments significant enough for revote
- Waiting on Editorial Committee review
- Z136.8- pending contains a number of items, I would like to brief this committee on
- Disappointment
 - Slow action by chairman
 - Ballot group has not been selected yet

New Diagrams



- **Elements of Figure 2A
LCA entrance**
- Printed laser warning sign on door
- Illuminated laser warning sign on side of door, near eye height, not over 6 feet (2 meters) from the floor
- Eye wear holder (can be located either inside or outside of LCA or both locations)
- Key Pad for interlock by –pass or authorized user entry
- Door bell, intercom or permission to enter device
- Emergency Entry device (unlocks door, may drop power or laser shutters), place out of random reach (or guarded to prevent random activation).

New Figures



New sign options



DANGER



LSO or contact information

Laser Radiation

Avoid Eye or Skin Exposure to Direct or Scattered Radiation

Access for authorized individuals only

Wavelength

Optical Density

Class 4



Using all of ANSI Sign standard, 535.2

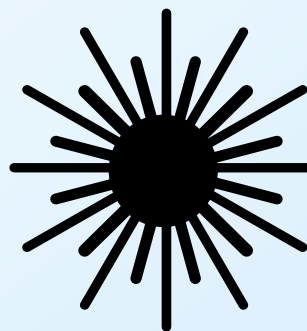
- The laser warning signs shall utilize warning statements as defined in Section 5 of ANSI Z535.2-1998 (or latest revision thereof), where the signal words have the following meanings:
- **“DANGER”** indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury. This signal word is to be limited to the most extreme conditions.
- **“CAUTION”** indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury. It may also be used to alert against unsafe practices.
- **“NOTICE”** is used to indicate a statement of facility policy as the message relates directly or indirectly to the safety of personnel or the protection of property. This signal word shall not be associated directly with a hazard or hazardous situation and must not be used in place of “DANGER” or “CAUTION.”
- **“WARNING”** is used to indicate a potentially hazardous situation which, if not avoided could result in death or series injury



First time use of Warning sign and label



Unattended Laser in Operation



**Access by authorized individuals only.
For emergency access and shut-down
see separate instructions**

In an emergency contact:

Name:

Phone



Fiber optic guidance

- **4.4.3.3 Fiber optic safety guidelines**
- Always work with fiber optic cables as if they were active live.
- Do not look straight into a fiber
- The NHZ from a fiber with a micro lens is similar to a collimated beam
- Make sure fibers are terminated into an instrument (power meter) or end caps.
- Do not touch your eyes while performing fiber termination or splicing work. Do not touch contact lenses until you are sure your hands are clean. Always wash your hands before touching your eyes.
- Do not eat in the same area you are working. Always wash your hands before eating. Glass pieces are the same as splinters and can cause internal hemorrhaging.
- The fiber strand ends are extremely sharp and can easily penetrate your skin or eye. When broken off they are very hard to find and remove.
- No smoking in work areas.
- Properly label all fibers in conduit and jacketed fiber(bare fibers may not accept labeling).



Non commercial lasers

It is highly recommended that lasers or laser systems that are in the control of the general public or may expose the general consumer shall meet the requirements of National product safety regulations and/or standards such as the Center for Devices and Radiological Health, 21 CFR1040.10 Federal Laser Product Performance Standard (FLPPS). **This standard ANSI Z136.8 recognizes that in a research setting both “certified” and “non-certified lasers”,** laser systems and components are in common use or systems developed prior to product registration. With training, user awareness and LSO authorization these non-certified devices can be used in a safe manner. **Therefore engineering controls listed in section 4.2, which might be required controls that are found in certified products, will be “preferred” in home built or non certified lasers, laser systems or components.** Prior to sending a laser system for technology transfer or use by others offsite, an effort should be made to bring them into existing product safety code compliance.



Expanded Robotic Section

- **4.4.4 Laser Robotic (Automated) Installations (Class 3B and Class 4).** In some applications (i.e. industrial) Class 3B and Class 4 lasers and laser systems are used in conjunction with robots or automated systems. In these situations, the robot working envelope should also include the NHZ associated with the laser. Automated laser installations in research settings should be of limited open beam path and have controls to restrict human access. The user needs to be aware that mechanical hazards maybe the greater risk to users. In all cases where the beam is focused by a lens associated with the robotic device, appropriate laser-robotic safeguards can be assured if:
 - (1) The design and/or control measures in combination provide for a positive beam termination during operation.
 - (2) The beam geometry is limited to only the necessary work task.
 - (3) All workers are located at a distance greater than or equal to the lens-on-laser NHZ value for the laser robotic system.
- In many instances, including those created by hardware failure and software errors, the laser beam from robotic delivery systems can be incident on the target surface at angles that could lead to potential scattering geometries that are very complex and require extensive evaluation. Measurements are often required to confirm the NHZ boundaries.
- **4.4.4.1 Laser Robotics with inaccessible beam paths.** A robotic (automated) installation can be set up so an open beam area is inaccessible to the user at an established control station. This can be from barriers, the foot print of the system or the limitations of the beam path. In such cases the Class 3B or Class 4 beam will be considered to meet the Class 1 system requirements.



Use locations

- **Unrestricted location** – access is not limited to people. By default, no optical radiation hazards exist (class 1), and these locations can be occupied by the general public, visitors, and spectators without implementing control measures (administrative, engineering, and personal protective equipment).
Example: A hall in a building containing class 3B or 4 lasers.
- **Restricted location** – access is granted for authorized people and limited for the general public through administrative and engineering control measures. By inference, optical radiation hazards at class 3B or greater may be present, and control measures are required. Administrative controls include posted warning signs, attending training, and following established SOP's for laser system(s). Engineering controls include access control measures such as lockable doors, barriers, defeatable interlocks, and curtains to prevent optical radiation from leaving the restricted location.
Example: A research laboratory containing class 3B and/or 4 lasers
- **Controlled location** – the access, occupancy, and activities of people within are subject to strict control and supervision. By inference, controlled locations are restricted locations with optical radiation hazards at class 4 with additional control measures specified by the laser operator, the LSO, and the employer management.
Example: A R&D area with positive access control and video surveillance.
- **Exclusion location** – occupancy by people is possible but is denied by the LSO during the operation of the laser system.
Example: A free electron laser machine room or beam path.
- **Inaccessible location** – occupancy by people is not possible due to its dimensions.
Example: An enclosed beam path on an optical table.



New Eyewear items

- **4.5.2.10.2 Limitations of Laser Eye Protection**
- **4.5.2.10.3 Use with High-power Lasers**
- **4.5.2.10.4 Saturable Absorption.**
- **4.5.2.10.5 Angle of Exposure**
- **4.5.2.6 Visible Transmission**

- **4.5.2.10 Alignment Eyewear**
- **4.5.2.10.1 Factors in Selecting Alignment Eyewear**



EN eyewear codes Section 4.6

- **Special Note:** Commercial laser protective eyewear may have a duplicate labeling compliant with European Norm 207 or 208.

- Testing conditions

D stands for continuous wave laser

I stand for pulse laser

R stands for Q Switched pulsed (pulse length 10^{-4} to 10^{-1} seconds)

M stands for mode-coupled pulse laser (pulse length $<10^{-9}$ seconds)

L stands for Scale number equivalent to OD, L1 = OD 1, L2 = OD 2 etc.



Sample audit forms

- Forms for program audit included
- Forms for laser lab audit included



Other variations from Z136.1

- Removal of most CDRH controls
 - Reproduction of CFR1040

- Standard points to ANSI Z136.1
 - Reduce need to change standard when MPE etc changes



Export Controls

- **4.4.5 Export Controls** The LSO should ensure that his institution is aware of existing export control regulations. These are federal laws that prohibit the unlicensed export of certain commodities or information for reasons of national security or protections of trade. A laser of any classification may be subject to these regulations due to the laser's type or application. These commodities or information include any oral, written, electronic or visual disclosure, shipment, transfer or transmission of commodities, technology, information, technical data, assistance or software codes to:
 - anyone outside the U.S., including a U.S. citizen
 - any non-U.S. individual, regardless of location
 - any foreign embassy or affiliate
- Many lasers do not require government licenses. However, licenses are required for exports that the U.S. government considers "license controlled" under:
- **The Department of Commerce's [Export Administration Regulations \(EAR\)](#)** which covers [15 CFR 730-774]
- **The Department of State's [International Traffic In Arms Regulations \(ITAR\)](#)** (also known as the U.S. Munitions List) covers defense-related items and services [22 CFR 120-130]:
- **The Treasury Department's Office of Foreign Assets Control (OFAC)** which covers [31 CFR §§500-599]



Moved from 3 to 5 Hazard Evaluation points

- **The capability of the laser or laser system to injure people**
- **The beam path (i.e. in air or vacuum), its configuration (i.e. open beam, fiber optic, level of enclosure) and the factors applied to beam (i.e. non-linear optics, compression or amplification)**
- **Process interactions between the beam and materials during its intended operation that produce ionizing radiation or laser generated air contaminants (LGAC's)**
- **The location in which the laser is used (i.e., unrestricted, restricted, controlled, inaccessible, exclusion)**
- **The personnel who may use or be exposed to laser radiation**



Summary

- Z136.8 will be an important addition to the Z136 series
- It is the sub-committees members hope that some of the new aspects of 136.8 will find its way to other standards
- ANSI approval process needs to be improved
- Hope to see Z136.8 published in 2011